Installation
& Operating Instructions

Series 5131
"Smart-Bloc I"® and "Smart-Bloc II"®
Liquid Level Controllers (Ver. 1.0)

Rev. A (8/10/92)

Kinematics & Controls Corporation
Deer Park, NY

INSTALLATION & OPERATING INSTRUCTIONS (REV.A) 8/10/92
Series 5131, "Smart-Blocs"® I & II (Ver.1.0)

SUPPORT.

Kinematics & Controls Corporation provides full technical support for its products. If you need assistance with any problem, please call us **Toll-Free at 1-800-833-8103**. Ask for technical support. Within N.Y. State, please call 516-595-1803.

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INTRODUCTION.

Series 5131 "Smart" Blocs are low-powered, modular, liquid level controllers for use with Kinematics', "BASIC" output, discrete point liquid level sensors. They are microprocessor based and D.I.N. rail mountable. "Smart-Bloc I"® models are single point controllers. "Smart-Bloc II"® models are dual point controllers.

This manual covers the installation and operating features of the following models.

P/N	**5131-0001**	"Smart-Bloc I"®	115V.-50/60 Hz.
P/N	**5131-0003**	"Smart-Bloc II"®	115V.-50/60 Hz.
P/N	**5131-0005**	"Smart-Bloc I"®	230V.-50/60 Hz.
P/N	**5131-0007**	"Smart-Bloc II"®	230V.-50/60 Hz.
P/N	**5131-0023**	"Smart-Bloc I"®	9-28 V.D.C.
P/N	**5131-0025**	"Smart-Bloc II"®	9-28 V.D.C.

All models are designed to:

1. Accept the appropriate voltage input;

2. Provide pulse-modulated, D.C. power to either one (1) or two (2) Kinematics' optoelectronic, discrete point, liquid level sensors, or to a single, Kinematics' dua point liquid level sensor.

2. Receive their return signals as microprocessor inputs.

3. Provide "dry" contact power output(s), and appropriate fault indication signal capability to the "outside world" in accordance with the selected mode of operation.

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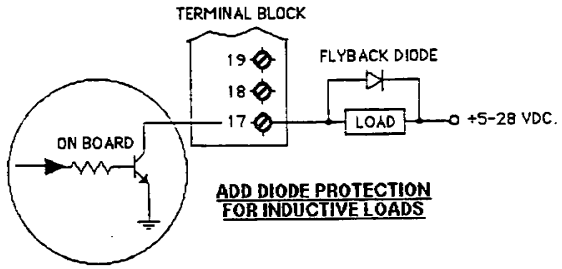
Terminal Configurations, "Smart-Bloc I"® & "Smart-Bloc II"®

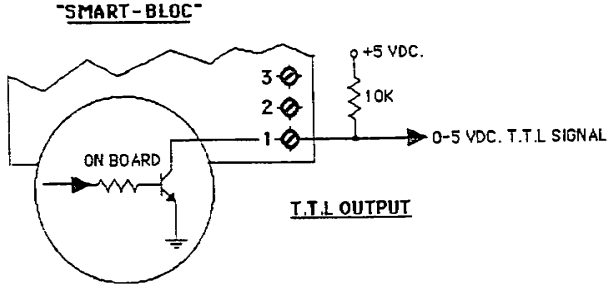
"Smart-Bloc I"®	"Smart-Bloc II"®
1. FAULT SIGNAL	1. FAULT SIGNAL, SENSOR #1
2. SENSOR GND.	2. SENSOR #1, GND.
3. UNUSED	3. SENSOR #2, GND.
4. UNUSED	4. FAULT SIGNAL, SENSOR #2
5. SENSOR SIGNAL	5 SIGNAL, SENSOR #1
6. SENSOR, Vcc	6. SENSOR #1, Vcc
7. UNUSED	7. SENSOR #2, Vcc
8. UNUSED	8. SENSOR #2, SIGNAL
9. UNUSED	9. N.O. CONTACT, SENSOR #2
10. UNUSED	10. N.O. CONTACT, SENSOR #2
11. N.O. RELAY CONTACT	11. N.O. CONTACT, SENSOR #1
12. N.O. RELAY CONTACT	12. N.O. CONTACT, SENSOR #1
13. UNUSED	13. UNUSED
14. UNUSED	14. UNUSED
15. A.C. LINE, (+V.D.C.)	15. A.C. LINE, (+V.D.C.)
16. A.C. NEUTRAL, (D.C. Ground)	16. A.C. NEUTRAL, (D.C. Ground)

Typical "Fault" Output Connection



Warning!!! When driving inductive loads such as relay coils, with open collector transistor outputs, a flyback diode must always be provided across the load as shown above.

Add 10K Pull-Up Resistor For 0-5 VDC. "Fault" Output



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INSTALLATION & OPERATING INSTRUCTIONS (REV.A) 8/10/92
Series 5131, "Smart-Blocs"® I & II (Ver.1.0)

SPECIFICATIONS.

Microprocessor	"Signetics" 87C752 or Equiv.
Module Size	1.16"W. X 3.12"D. X 2.72"H.
Mounting	D.I.N Rail or Flush Mounting.
Input Voltage	Standard, 115 Volt, 50/60 Hz.
	Optional, 230 Volt, 50/60 Hz.
	Or, 9-28 Volts D.C.
Output	Dry Contacts (1 Form A), 10 Amp. @ 250 V.A.C.,30 V.D.C.
Fault Output	Open Collector Transistor, 300 ma. (Max.)
Power Consumption	25 ma. (Avg.), 50 ma. (Max.)
Operating Temperature Range	(-)20°C To (+)80°C.

FEATURES.

• **Adjustable Threshold**. A 12-turn potentiometer provides the user the means for fine tuning each sensor in the system.

• **User Selectable Modes**. The user selectable options include selection of operating "Mode", [i.e., "Independent" action or "Dual" action (Pump "up"/ Pump "down"); Sensor normally "Wet" or normally "Dry"; Time Delay on "Make" only; Time Delay on "Break" only; Time Delay on both "Make" and "Break"; No Time Delay; and Sensor disable.

• **Ambient Light Immunity**. "Smart" blocs provide a multiplexed, pulse-modulated input to each sensor, and a filtered receiver/amplifier circuit, for virtual immunity to false triggering by incident ambient light.

• **Continuous Fault Monitoring**. A fault monitoring algorithm continually monitors the condition of each sensor, and reports any faulty or non-functional sensor immediatly upon it's detection.

• **L.E.D. Indicator**. Face mounted L.E.D. provides visual indication of the status of the relay.

• **D.I.N. Rail Mounting**. Universal mounting on any of three D.I.N. rail styles.

USER SELECTABLE OPTIONS.

Both "Smart-Bloc I"® and "Smart-Bloc II"® are user programmable by selecting an appropriate position on a hexadecimal rotary DIP switch. The switch actuator is accessible through the center hole in the front face of each panel. Eight "Independent" modes are provided on both "Smart-Bloc I"® and "Smart-Bloc II"®. Additionally, "Smart-Bloc II"® supports two "Dual" modes of operation_"Pump-Up" and "Pump-Down". One position of the Hex switch disables the sensor connected to that channel.

• Modes of Operation.

1. "INDEPENDENT MODES". "Smart-Bloc I"®, liquid level controllers work in conjunction with a single sensor in any one of the eight "Independent" modes listed below. "Smart-Bloc II"®, controllers also are able to control either one or two sensors, each with it's own independent operating mode.

HEX	FUNCTION
0	Normally "Wet" (Energize when dry), 0 Sec. Delay "Make", 0 Sec. Delay "Break".
1	Normally "Wet" (Energize when dry), 0 Sec. Delay "Make", 5 Sec. Delay "Break".
2	Normally "Wet" (Energize when dry), 5 Sec. Delay "Make", 0 Sec. Delay "Break".
3	Normally "Wet" (Energize when dry), 5 Sec. Delay "Make", 5 Sec. Delay "Break".
4	Normally "Dry" (Energize when wet), 0 Sec. Delay "Make", 0 Sec. Delay "Break".
5	Normally "Dry" (Energize when wet), 0 Sec. Delay "Make", 5 Sec. Delay "Break".
6	Normally "Dry" (Energize when wet), 5 Sec.Delay "Make", 0 Sec. Delay "Break".
7	Normally "Dry" (Energize when wet), 5 Sec.Delay "Make", 5 Sec. Delay "Break".
F	Sensor Disable.

Only the "Independent" modes are functional in "Smart-Bloc I"®. In "Smart-Bloc II"®, one of the eight "Independent" modes of operation is chosen when it is desired to have the output relays respond independently and directly to changes in the "Wet/Dry" state of each of the sensors. The microprocessor performs no "logic" functions in any of the independent modes. When using "Smart-Bloc II"® with two sensors in any of the "Independent" modes, both sensors may be in one tank, or they may be installed in different tanks. In any of the "Independent" modes, the appropriate "FAULT" output will go "LOW" when any sensor experiences a failure or a fault.

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OUTPUT CONNECTIONS.

Power Outputs.

"Smart-Bloc I"® controllers have a single, 1 Form A, relay contact output across terminals 11 & 12.

"Smart-Bloc II"® controllers have two (2) "1 Form A" relay contact outputs. When operating any of the "Smart-Bloc II"® controllers in one of the "Independent" modes, the output relay contacts for channel 1 (Black) are across terminals 11 & 12. The output relay contacts for channel 2 (White) are across terminals 9 & 10.

When operating "Smart-Bloc II"® controllers in one of the "Dual" modes, the two internal relays operate together as a "2 Form A" relay.

Contact ratings for all "Smart-Bloc" relays are 10 Amps. @ 250 V.A.C., 30 V.D.C.

The state of each relay may be observed on the status L.E.D.'s. on the front face of the "Smart-Blocs". Status L.E.D.'s are "OFF" when the associated relay contacts are "OPEN", and "ON" when they are "CLOSED".

Fault Outputs.

In order to take advantage of this feature, sensors with the integral fault monitoring option ("-F" suffix) must be used in conjunction with the "Smart-Blocs"®.

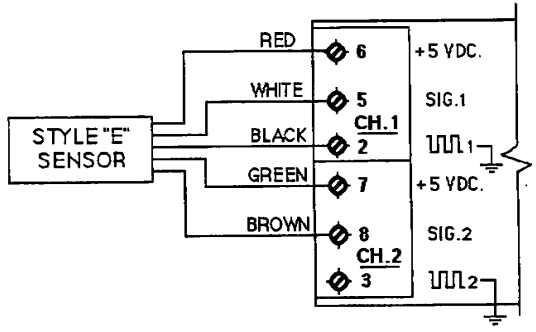
"Smart-Bloc I"® has a single, open collector transistor output for fault signalling at terminal position 1.

"Smart-Bloc II"® has open collector transistor outputs for fault signalling at terminal positions 1 & 4. When operating any of the "Smart-Bloc II"® controllers in one of the "Independent" modes, the output at terminal position 1 indicates the condition of the sensor on channel 1 (Black), while the output at terminal position 4 indicates the condition of the sensor on channel 2 (White).

Connect these points to the appropriate output device as shown in the diagrams on page 23 below.

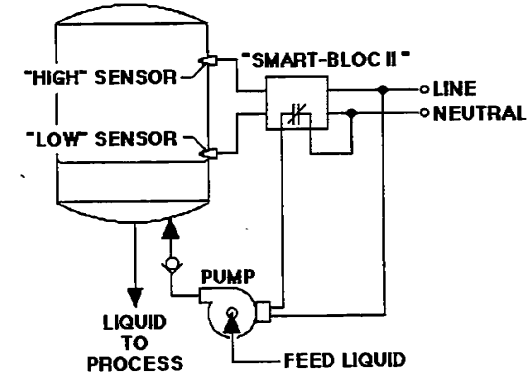
Connecting Style "E" Sensors

"Smart-Bloc II"



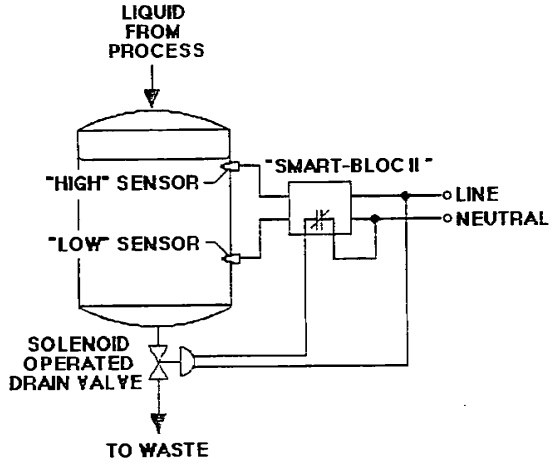
2. "DUAL" MODES. Although "Smart-Bloc II"® controllers will support a single sensor working alone on either channel, they are designed primarily to logically link together the action of two single-point sensors, or the two points of a single dual-point sensor. When two sensors or a dual-point level sensor are used, the action of each the sensing points may be chosen to be completely independent of each other as described above, or their action may be tied together in one of two "Dual" modes. The two additional "Dual" sensor modes, "Pump-Up" (Hex "D") and "Pump-Down" (Hex "E"), are described below.

Pump-Up Mode. The Pump-Up control mode is chosen when it is desired to maintain a constant level between two points in a process tank, and the process is normally depleting liquid from the tank. In this mode, the controller's output relay contacts are closed only when both sensors are dry, and are open only when both are wet. The schematic below best describes this mode.



On power-up, both of the sensors are dry. Consequently, the controller's output relay contacts close to start a pump or open a "fill" valve. The liquid flows into the tank until it's level rises to a point above the upper sensor. Now both sensors are wet, and the relay contacts open, stopping the pump. When the process causes the liquid level to fall below the lower sensor, both sensors again become dry, and the filling action restarts to restore the liquid to it's higher level.

Pump-Down Mode. The Pump-Down control mode is chosen when it is desired to maintain a constant level between two points in a process tank, and the process is normally adding liquid to the tank. In this mode, the controller's output relay contacts are closed only when both sensors are wet, and are open only when both are dry. The schematic below best describes it's operation.



On power-up, the tank is empty and both sensors are dry. The output relay contacts, therefore, are open, and no action occurs. As the process fills the tank, it's level rises to the point where eventually both sensors are wet. The relay contacts now close, and a "waste" pump starts or a "drain" valve is held open until the level in the tank drops to a point below the lower sensor. When the level reaches the point where both sensors are again dry, the relay contacts open and the draining action stops. When the process again causes the level to rise above the upper sensor, and both sensors are again wet, the draining action resumes to drop the liquid to a point below it's lower level.

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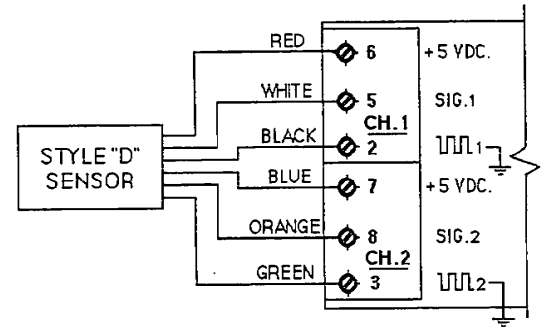
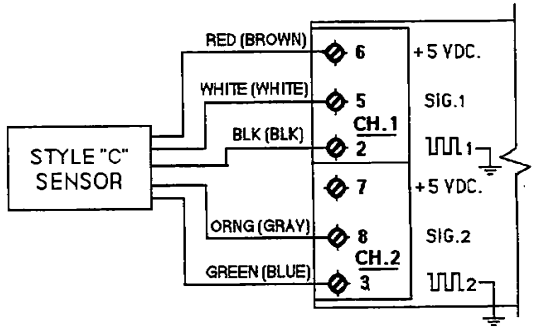
Connecting Style "D" Sensors

"Smart-Bloc II"



Connecting Style "C" Sensors

"Smart-Bloc II"



• **Sensor Disable**. The user may totally enable or disable any or both of the two sensor channels. This is useful in temporarily silencing alarms from faulty sensors, or in preventing such alarms in cases where one of the channels is not being utilized. Whenever a channel is not being used, it should be disabled to prevent a constant FAULT condition from being reported.

INSTALLATION & SETUP PROCEDURE.

Refer to the diagrams and tables referenced in each paragraph below, and follow these simple steps for quick and easy installation.

1. **Fasten the "Smart-Blocs" in place**. Both "Smart-Bloc I"® & "Smart-Bloc II"® are D.I.N. rail mountable. Each is shipped with a small segment of perforated 35mm. D.I.N. rail to allow flush mounting in systems which do not utilize a D.I.N. rail mounting system. Remove and discard this small segment of D.I.N. rail for direct mounting into panels which already have a D.I.N. rail system installed.

2. **Connect the sensors** each to the appropriate terminal positions. Sometimes all of the terminal block positions are not utilized. Refer to the sensor outline and connection diagrams on pages 15-21 of this manual, or to the label on the side of the "Smart-Bloc"®, for the correct wiring scheme required for the particular sensor and "Smart-Bloc" purchased.

Caution! Double check all sensor connections before applying power to the "Smart-Bloc"® Controllers. Improper connection will damage or destroy the sensors. Never connect or disconnect sensors while there is power applied to the controller.

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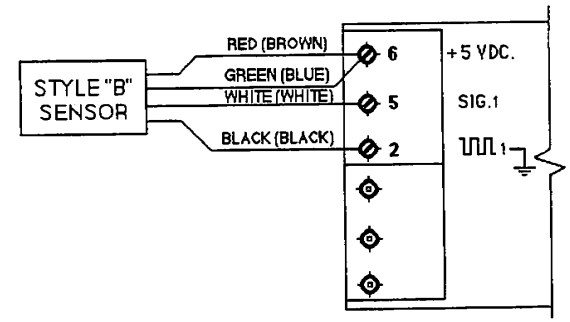
3. **Calibrate**. First, set the mode selection switch to position "4". Immerse the sensor to be calibrated in the working fluid and apply power. (See step 5. below.) If the "Status" L.E.D. is "OFF", slowly turn the potentiometer clockwise until the L.E.D. just turns "ON", then continue in the SAME direction for another 1/4 turn. The sensor is now properly calibrated.

   If, however, the "status" L.E.D. is "ON", slowly turn the potentiometer counter-clockwise until the L.E.D. turns "OFF". Now turn it slowly back in the clockwise direction until the L.E.D. just turns "ON", then continue in the same direction for another 1/4 turn. The sensor is now properly calibrated.

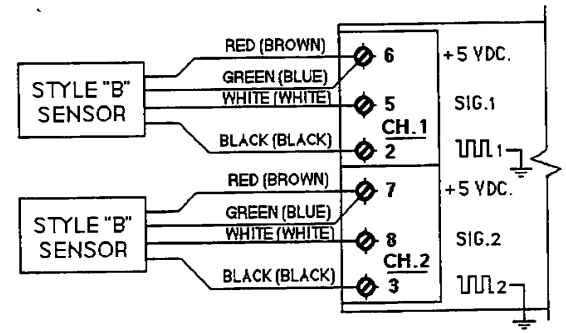
   If turning the potentiometer full range in both directions fails to evoke a change in the state of the status L.E.D., consult the factory for technical assistance.

Connecting Style "B" Sensors

"Smart-Bloc I"

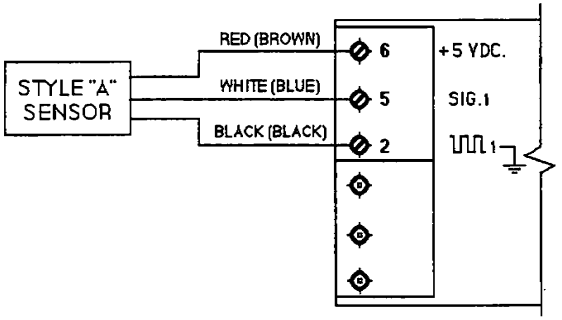


"Smart-Bloc II"

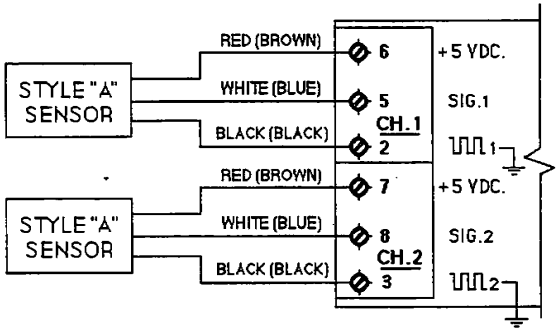


Connecting Style "A" Sensors

"Smart-Bloc I"



"Smart-Bloc II"



4. **Connect outputs**. Remove the power and connect each of the available required relay outputs to its respective output device or P.L.C. Refer to the output connection diagrams on pages 21-22 of these instructions, or to the label on the side of the "Smart-Bloc"®, for the correct output wiring scheme.

5. **Connect power**. Connect t the controller to the proper power supply. Double check the rated voltage of the model you are installing. Refer to the tables on page 22 of this manual, or to the side label on the device, for the proper power connection scheme for each of the above models.

6. **Program the Module**. Select the desired mode of operation by positioning the Hexadecimal rotary D.I.P. switch to the desired functional setting as outlined in User Selectable Options above. Refer to the summary tables on pages 10-11 below, or on the side label of the "Smart-Bloc"® itself.

7. **Your installation is now complete!**

TABLES.

Summary of User Programmable Functions, "Smart-Blocs I & II"® (Hexadecimal Rotary D.I.P. Switch Settings)

"Smart-Bloc I"®. Only Hex positions zero (0) thru seven (7) are functional on "Smart-Bloc I"®. Selection of Hex position "F" disables the sensor completely. All other positions are unused.

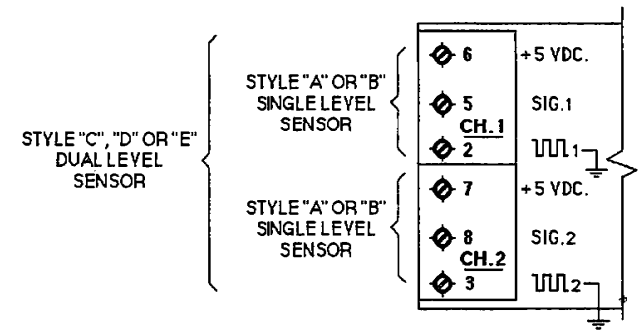
Table 1. "Smart-Bloc I"® Programmable Functions

Hex	"Make" Relay	Time Delay (Sec.) On "Make"	On "Break"
"0"	Dry	0	0
"1"	Dry	0	5
"2"	Dry	5	0
"3"	Dry	5	5
"4"	Wet	0	0
"5"	Wet	0	5
"6"	Wet	5	0
"7"	Wet	5	5
"8"	Unused	Unused	Unused
"9"	Unused	Unused	Unused
"A"	Unused	Unused	Unused
"B"	Unused	Unused	Unused
"C"	Unused	Unused	Unused
"D"	Unused	Unused	Unused
"E"	Unused	Unused	Unused
"F"	<----------Sensor Disabled---------->		

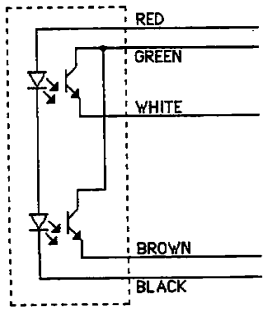
SENSOR CONNECTIONS.

All of the Kinematics' "A" and "B" style optoelectronic liquid level sensors shown above are connected to "Smart-Bloc I"® at terminal block positions 2, 5, and 6. Note that in connecting the style "B", 4-wire sensors to "Smart-Bloc I"®, the red (brown) and green (blue) leads are connected together at terminal position 6. "Smart-Bloc II"® controllers will accept and function with any of the single or dual point sensors (styles "A" thru "E" shown above. Terminal positions 2, 3, 5, 6, 7, & 8 are used for sensor inputs to this controller. Refer to the general connection scheme below, and to the specific connection diagrams for each sensor type on the following pages. Always "Disable" any sensor channel not being utilized to avoid the possibility of any false signaling.

General Connection Scheme



STYLE "E"
DUAL LEVEL SENSOR
(5-WIRE, SERIES)



"Smart-Bloc II"®. "Smart-Bloc II"® controllers have two sensor channels. Channel 1 is the left hand channel. It's markings are printed in black ink. Channel 2 is on the right hand side. It's markings are silk screened in white ink. When using "Smart-Bloc II"® controllers with sensors which are to function independently, both Channel 1 and Channel 2 Hex switches must be set to the mode desired for each sensor. "Dual" mode settings are made ONLY on Channel 1 for BOTH sensors. Selection of either of the "Dual" modes on Channel 1 will override any selection made on Channel 2, except for Hex "F", "Sensor Disable". Disabling Channel 2 will allow a sensor on Channel 1 to function in any of the "Independent" modes. Conversely, disabling a sensor on Channel 1 will allow a sensor on Channel 2 to function in any of the "Independent" modes. However, disabling Channel 2 with one of the "Dual" modes selected on Channel 1 will disable both sensors.

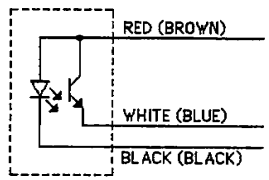
Table 2. "Smart-Bloc II"® Programmable Functions

	Channel 1 (Black)				Channel 2 (White)			
Hex	"Make" Relay	<----Time Delay ----> On "Make"	On "Break"		Hex	"Make" Relay	<----Time Delay ----> On "Make"	On "Break"
"0"	Dry	0	0		"0"	Dry	0	0
"1"	Dry	0	5		"1"	Dry	0	5
"2"	Dry	5	0		"2"	Dry	5	0
"3"	Dry	5	5		"3"	Dry	5	5
"4"	Wet	0	0		"4"	Wet	0	0
"5"	Wet	0	5		"5"	Wet	0	5
"6"	Wet	5	0		"6"	Wet	5	0
"7"	Wet	5	5		"7"	Wet	5	5
"8"	Unused	Unused	Unused		"8"	Unused	Unused	Unused
"9"	Unused	Unused	Unused		"9"	Unused	Unused	Unused
"A"	Unused	Unused	Unused		"A"	Unused	Unused	Unused
"B"	Unused	Unused	Unused		"B"	Unused	Unused	Unused
"C"	Unused	Unused	Unused		"C"	Unused	Unused	Unused
"D"	Pump UP	0	0		"D"	Unused	Unused	Unused
"E"	Pump DOWN	0	0		"E"	Unused	Unused	Unused
"F"	<----- Sensor Disabled ----->				"F"	<----- Sensor Disabled ----->		

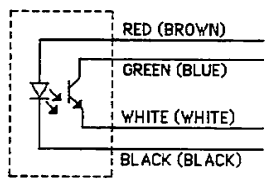
SENSOR STYLES.

The following diagrams illustrate the various styles of Kinematics' liquid level sensors that will function with this version of "Smart-Bloc"® controllers. The diagrams on pages 15-20 in the following section illustrate how these different sensors are connected to the board. Note that some sensor styles have altemate color schemes for the wiring.

STYLE "A"
SINGLE LEVEL SENSOR
(3-WIRE)



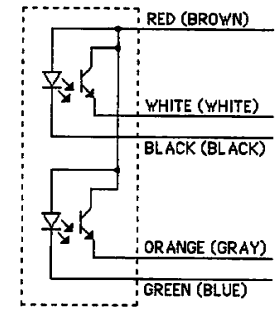
STYLE "B"
SINGLE LEVEL SENSOR
(4-WIRE)



Kinematics & Controls Corporation ..... Deer Park, NY

INSTALLATION & OPERATING INSTRUCTIONS (REV.A) 8/10/92
Series 5131, "Smart-Blocs"® I & II (Ver.1.0)

STYLE "C"
DUAL LEVEL SENSOR
(5-WIRE, PARALLEL)



STYLE "D"
DUAL LEVEL SENSOR
(6-WIRE)